

REMARKS/ARGUMENTS

This is Applicants' response to the Non-Final Office Action of August 13, 2008 in which claims 1-7, 11-14, 18-21, and 24-34 were rejected, and claims 1, 21, and 25 were objected to. Claim 1 is amended and is fully supported by the application as originally filed at page 1, paragraph [0003]; page 4, paragraph [0017]; page 17, paragraph [0058], pages 17-18, paragraph [0059]. Claims 2-7, 11-14, and 18-20 have been amended to recite in part "The fluidized-bed reactor system" in accordance with claim 1 from which they depend. Claim 3 is amended and is fully supported by the application as originally filed at page 1, paragraph [0003] and page 17, paragraph [0058]. Claim 5 is amended and is fully supported by the application as originally filed at page 1, paragraph [0003]; page 4, paragraph [0017]; page 9, paragraph [0034]; pages 10-11, paragraph [0038]; page 17, paragraph [0058], pages 17-18, paragraph [0059]. Claim 21 is amended and is fully supported by the application as originally filed at page 1, paragraph [0003]; page 4, paragraph [0017]; page 9, paragraph [0034]; pages 10-11, paragraph [0038]; page 17, paragraph [0058], pages 17-18, paragraph [0059]. Claim 25 is amended and is fully supported by the application as originally filed at page 1, paragraph [0003]; page 4, paragraph [0017]; page 10, paragraph [0037]; page 17, paragraph [0058], pages 17-18, paragraph [0059]. Claims 35-37 are new and are fully supported by the application as originally filed at page 13, paragraph [0048] and page 17, paragraph [0058].

Claims 1, 21, and 25 were objected to because of an informality. Applicants have amended claims 1, 21, and 25 to recite in part "cadmium sulfide", which is believed to render the objection moot. Withdrawal of the objection is respectfully requested.

Claims 1-5, 11-13, and 21 were rejected under 35 U.S.C. 103(a) as being unpatentable over Nishimura (JP 2003-334424) and evidenced by Kinkade (US 4,994,498). Nishimura does not teach or suggest “a fluidizing input, located downstream of the first input, for introducing a fluidizing material into the hollow interior region”, as recited in amended independent claim 1. The Office Action points to the introductory tubing 11 of Nishimura as being both the “first input” and the “fluidizing input.” *Office Action 8/13/08, page 3*. But the introductory tubing 11 of Nishimura is not “a fluidizing input, located downstream of the first input, for introducing a fluidizing material into the hollow interior region” where the “first input [is] for introducing a contaminated gas into the hollow interior region.” The introductory tubing 11, as shown in Drawing 2 and described as being located “in the bottom part” of the floating reactor 10 (*Nishimura paragraph [0015]*), is used for the entrance of the photocatalyst mixed with the polluted gas into the reactor 10. Nishimura does not disclose or suggest any other stream entering the reactor 10. Claims 2-4 and 11-13 depend from claim 1 and are patentable on the same basis.

Moreover, with respect to claim 4, Nishimura does not teach or suggest “a second input for introducing a backpressure pulse of gaseous material into the hollow interior region through the port” wherein the port is “for the exit of the decontaminated gas comprising carbon dioxide out of the hollow interior region” (emphasis added). First, the cleaning means 26 of Nishimura introduces gaseous material into filter 25 inside the eliminator 20; the cleaning means 26 of Nishimura does not introduce gaseous material into the floating reactor 10. Second, the cleaning means 26 of Nishimura does not introduce gaseous material “through the port” wherein the port is “for the exit of the

decontaminated gas comprising carbon dioxide out of the hollow interior region.” In Nishimura, the decontaminated gas exits the floating reactor 10 through the exhaust pipe 12 (“[A] photocatalyst is separated from the gas which flows in an eliminator 20 from an exhaust pipe 12, a photocatalyst is dropped to a hopper 21, and gas passes a filter 25 and is exhausted out of a system from the top exhaust port 24”, *Nishimura paragraph [0017]*). The cleaning means 26 in Nishimura does not introduce gaseous material through the exhaust pipe 12.

Moreover, with respect to claim 5, Nishimura does not teach or suggest “the entrance of the backpressure pulse into the hollow interior region through the port displaces collected catalyst nanoparticles and allows said collected catalyst nanoparticles to flow through the port directly back into the hollow interior region to join the fluidized catalyst nanoparticles and continue catalyzing the break down of contaminated gas within the hollow interior region.” First, the cleaning means 26 of Nishimura introduces gaseous material into filter 25 inside the eliminator 20. The cleaning means 26 in Nishimura does not introduce gaseous material through the exhaust pipe 12. Second, the photocatalyst particles of Nishimura do not “flow through the port directly back into the hollow interior region”, where exhaust pipe 12 would be the port. And the photocatalyst particles of Nishimura do not “join the fluidized catalyst nanoparticles and continue catalyzing.” The photocatalyst particles of Nishimura enter a hopper 21 at the bottom of eliminator 20, and the “lower part of the hopper 21 is connected with the introductory tubing 11 through the constant feeding valve (rotary valve) 22.” *Nishimura paragraph [0017]*.

Moreover, with respect to claim 13, nowhere does Nishimura teach or suggest “the ultraviolet light is positioned outside the chamber.” Figure 2 of Nishimura shows the

mercury vapor lamp 15 inside the floating reactor 10, and paragraph 9 states, “The gas purifying facility of this invention is characterized by coming to install the high-output mercury-vapor lamp for UV irradiation in the shaft orientations of said floating reactor.”

Regarding independent claim 21, Nishimura does not teach or suggest “a fluidizing input, located downstream of the first input, for introducing a fluidizing material into the hollow interior region”, as recited in amended independent claim 21. The Office Action points to the introductory tubing 11 of Nishimura as being both the “first input” and the “fluidizing input.” *Office Action 8/13/08, page 3*. But the introductory tubing 11 of Nishimura is not “a fluidizing input, located downstream of the first input, for introducing a fluidizing material into the hollow interior region” where the “first input [is] for introducing a contaminated gas into the hollow interior region.” The introductory tubing 11, as shown in Drawing 2 and described as being located “in the bottom part” of the floating reactor 10 (*Nishimura paragraph [0015]*), is used for the entrance of the photocatalyst mixed with the polluted gas into the reactor 10. Nishimura does not disclose or suggest any other stream entering the reactor 10. Also with respect to claim 21, Nishimura does not disclose or suggest “introducing a backpressure pulse into the hollow interior region through the port and separation device so as to displace catalyst nanoparticles from the separation device.” The cleaning means 26 of Nishimura introduces gaseous material into filter 25 inside the eliminator 20. The cleaning means 26 in Nishimura does not introduce gaseous material through the exhaust pipe 12. Also with respect to claim 21, Nishimura does not disclose or suggest “allowing the plurality of catalyst nanoparticles displaced from the gas separation device to directly join the fluidized dispersion of catalyst nanoparticles and continue catalyzing the break down of the

contaminated gas within the hollow interior region.” The photocatalyst particles of Nishimura enter a hopper 21 at the bottom of eliminator 20, and the “lower part of the hopper 21 is connected with the introductory tubing 11 through the constant feeding valve (rotary valve) 22.” *Nishimura paragraph [0017]*.

Withdrawal of the rejection of claims 1-5, 11-13, and 21 under 35 U.S.C. 103(a) in view of Nishimura and Kinkade is respectfully requested.

Claim 14 was rejected under 35 U.S.C. 103(a) as being unpatentable over Nishimura (JP 2003-334424) and evidenced by Kinkade (US 4,994,498) as applied to claim 11, and further in view of Goswami (US 5,933,702). The addition of Goswami does not overcome the deficiencies of Nishimura and Kinkade with respect to suggesting independent claim 1 from which claim 14 depends. Moreover, with respect to claim 14, there is no reason to combine Goswami with the other references. Goswami is directed to destroying microorganisms in air by photocatalytic oxidation. Goswami discloses a “master reactor 21 along the duct 18” of an air conditioning system. *Goswami col. 6, line 13*. The reactor 21 includes a catalyst-coated liner 29 and/or a catalyst-coated mesh or matrix of surfaces 28, where “the catalyst-coated liner and mesh are referred to collectively as catalytic inserts.” *Goswami col. 6, lines 18-24*. And the “mesh 28 may be made out of any material to which a photocatalyst will adhere by conventional methods. The duct liners 29 may be made of any material that will allow the deposition and adherence of a photocatalyst on its interior surface 31 by conventional methods.” *Goswami col. 6, lines 58-62*. The humidifier 50 of Goswami is used to humidify the circulating air to “a relative humidity greater than about 40%” (*col. 7, lines 66-67*) because “the relative humidity level

of the air is critical for the destruction of microorganisms” (*col. 7, lines 61-62*). Thus, Goswami does not disclose or suggest in any way a fluidized-bed reactor system. There is no reason to use the humidifier 50 of Goswami in the reactor of Nishimura, and the combined teachings of Goswami, Nishimura, and Kinkade do not result in the limitations of claim 14. Nishimura is not concerned with destroying microorganisms. Goswami specifically describes the adherence of the photocatalyst to the mesh 28 or duct liners 29. Nothing in Goswami suggests “the fluidizing material fluidizes at least a portion of the plurality of catalyst nanoparticles located at the lower surface of the chamber to form a gaseous dispersion”, as recited in claim 1 from which claim 14 depends. Goswami also does not disclose or suggest “a plurality of catalyst nanoparticles within the hollow interior region and located on the lower surface, wherein the catalyst nanoparticles have an average particle diameter of about 15 nm to about 25 nm, and wherein the catalyst nanoparticles are capable of catalyzing the break down of a contaminated gas to produce a decontaminated gas comprising carbon dioxide”, as recited in claim 1 from which claim 14 depends. Nor does Goswami disclose or suggest “a fluidizing input, located downstream of the first input, for introducing a fluidizing material into the hollow interior region”, as recited in claim 1 from which claim 14 depends. Withdrawal of the rejection of claim 14 under 35 U.S.C. 103(a) is respectfully requested.

Claim 24 was rejected under 35 U.S.C. 103(a) as being unpatentable over Nishimura (JP 2003-334424) and evidenced by Kinkade (US 4,994,498) as applied to claim 21, and further in view of Ballantine et al (US 2006/0078771). The addition of Ballantine et al does not overcome the deficiencies of Nishimura and Kinkade with respect

to suggesting independent claim 21 from which claim 24 depends. Moreover, Ballantine et al discloses a fuel cell system with a normal operating mode of certain valves being open and others closed. *Ballantine et al*, paragraph [0039]. When the fuel cells system requires a purging of reactants, alternated valve conditions are triggered, which reverses the flow of the reactant gases while simultaneously conducting a purge. *Ballantine et al*, paragraph [0039]. Ballantine does not teach or suggest “synchronizing the function of the second input for introducing a backpressure pulse of gaseous material into the hollow interior region to function with at least one of a group comprising the first input for introducing a contaminated gas into the hollow interior region, the fluidizing input for introducing a fluidizing material into the hollow interior region and combinations thereof”, as recited in claim 24. There is no suggestion or motivation to combine the fuel cell control system of Ballantine et al with Nishimura. Withdrawal of the rejection of claim 24 under 35 U.S.C. 103(a) is respectfully requested.

Claim 25 was rejected under 35 U.S.C. 103(a) as being unpatentable over Nishimura (JP 2003-334424) in view of Ballantine et al (US 2006/0078771) and evidenced by Kinkade (US 4,994,498). First, Nishimura does not teach or suggest “a fluidizing input located downstream of the first input” and “the fluidizing input configured to direct a fluidizing material toward the lower surface and between about 0° to 90° with respect to the lower surface and the plurality of catalyst nanoparticles for fluidizing at least a portion of the plurality of catalyst nanoparticles and creating a gaseous dispersion of catalyst nanoparticles that catalyzes the break down of the contaminated gas to produce a decontaminated gas comprising carbon dioxide”, as recited in amended independent claim

25. The Office Action points to the introductory tubing 11 of Nishimura as being both the “first input” and the “fluidizing input.” *Office Action 8/13/08, page 7.* But the introductory tubing 11 of Nishimura is not “a fluidizing input, located downstream of the first input” where the “first input [is] for introducing a contaminated gas into the hollow interior region.” The introductory tubing 11, as shown in Drawing 2 and described as being located “in the bottom part” of the floating reactor 10 (*Nishimura paragraph [0015]*), is used for the entrance of the photocatalyst mixed with the polluted gas into the reactor 10. Nishimura does not disclose or suggest any other stream entering the reactor 10.

Second, Nishimura does not teach or suggest “the second input configured to direct a backpressure pulse of gaseous material into the hollow interior region through the gas permeable separation device for displacing the plurality of catalyst nanoparticles previously collected on the gas permeable separation device therefrom”, as recited in amended claim 25. The cleaning means 26 of Nishimura introduces gaseous material into filter 25 inside the eliminator 20. The cleaning means 26 of Nishimura does not introduce gaseous material into the floating reactor 10.

Third, Nishimura does not teach or suggest “allowing the plurality of catalyst nanoparticles displaced from the gas separation device to join the fluidized dispersion of catalyst nanoparticles and continue catalyzing the break down of the contaminated gas within the hollow interior region”, as recited in amended claim 25. In Nishimura, the “photocatalyst is dropped to a hopper 21” at the “bottom of an eliminator 20.” *Nishimura, paragraph [0017]*. Thus, the photocatalyst particles of Nishimura do not “join the fluidized dispersion of catalyst nanoparticles and continue catalyzing.”

Fourth, Ballantine does not teach or suggest “at least one control device coupled to the second input and at least one of the first and fluidizing inputs, the at least one control device configured to alternate the backpressure pulse of gaseous material through the gas permeable separation device with an entrance of at least one of the contaminated gas and the fluidizing material into the hollow interior region”, as recited in claim 25. Ballantine et al is directed to a fuel cell system with a normal operating mode of certain valves being open and others closed. *Ballantine et al*, paragraph [0039]. When the fuel cells system requires a purging of reactants, alternated valve conditions are trigger, which reverses the flow of the reactant gases while simultaneously conducting a purge. *Ballantine et al*, paragraph [0039]. There is no suggestion or motivation to combine the fuel cell control system of Ballantine et al with Nishimura. Withdrawal of the rejection of claim 25 under 35 U.S.C. 103(a) is respectfully requested.

Claim 26 was rejected under 35 U.S.C. 103(a) as being unpatentable over Nishimura (JP 2003-334424) in view of Ballantine et al (US 2006/0078771) and evidenced by Kinkade (US 4,994,498) as applied to claim 25, and further evidenced by Breton et al (US 3,997,447). Breton et al merely discloses that the “frequency of backpulsing and ratio of forward flow to reverse flow” in a fluid processing device can be modified. *Breton et al col. 5, lines 39-43*. Breton et al does not disclose or suggest “wherein the at least one control device is further configured to . . . introduce at least one of the contaminated gas and the fluidizing material into the hollow interior region for about 0.8 seconds.” *Breton et al col. 4, lines 65-67*. The addition of Breton et al does not overcome the deficiencies of Nishimura, Ballantine et al, and Kinkade with respect to suggesting independent claim 25

from which claim 26 depends. Withdrawal of the rejection of claim 26 under 35 U.S.C. 103(a) is respectfully requested.

Claims 1-3 were rejected under 35 U.S.C. 103(a) as being unpatentable over Becker et al (US 2002/0006368) in view of Zhou (US 6,500,969) and evidenced by Kinkade (US 4,994,498). Amended claim 1 recites in part a fluidized-bed reactor system “wherein the catalyst nanoparticles are capable of catalyzing the break down of a contaminated gas to produce a decontaminated gas comprising carbon dioxide” and “a reaction product comprising carbon dioxide in the hollow interior region.” Becker et al does not teach or suggest these limitations. Becker et al discloses a fluid bed reactor for use in synthesis reactions, not decomposition reactions. Specifically, Becker et al states that “suitable processes . . . for use in the present invention include (a) the acetoxylation of olefins, for example the reaction of ethylene, acetic acid and oxygen to produce vinyl acetate, (b) the oxidation of ethylene to acetic acid and/or the oxidation of ethane to ethylene and/or acetic acid, (c) the ammoxidation of propylene, propane or mixtures thereof to acrylonitrile and (d) the oxidation of C4’s to maleic anhydride.” *Becker et al. page 3, paragraph [0028], [0035], and [0037]*. Becker et al does not teach or suggest a fluidized-bed reactor system including “a first input for introducing a contaminated gas into the hollow interior region, the contaminated gas comprising at least one hydrocarbon contaminant”, as recited in part in claim 1. The Office Action points to “inlet (6)” but Becker et al states that the reactor “is provided with . . . a supply of fluidising gas comprising recycle gases, ethylene reactant and optionally oxygen reactant through inlet (6).” *Becker et al, page 3, paragraph [0032]*. In addition, Becker et al does not teach or

suggest “wherein the catalyst nanoparticles are capable of catalyzing the break down of a contaminated gas to produce a decontaminated gas comprising carbon dioxide”, and “a reaction product comprising carbon dioxide in the hollow interior region”, as recited in part in claim 1. The Office Action states that it would have been obvious to use the nanoparticles of Zhou in the reactor of Becker “in order to ensure high activity and selectivity of the desired oxidation products.” *Office Action, page 12*. But Zhou does not disclose or suggest catalyst nanoparticles “wherein the catalyst nanoparticles are capable of catalyzing the break down of a contaminated gas to produce a decontaminated gas comprising carbon dioxide.” Zhou et al discloses that in the first of a two-stage process, “nanometer-size crystals of supported particles of noble metal catalyst” are used to catalyze the formation of “hydrogen peroxide intermediate . . . at hydrogen concentrations below the flammability limits of hydrogen.” *Zhou, col. 5, lines 3-8*. Claims 2-3 depend from claim 1 and are patentable on the same basis. Withdrawal of the rejection of claims 1-3 under 35 U.S.C. 103(a) is respectfully requested.

Claims 4-5 were rejected under 35 U.S.C. 103(a) as being unpatentable over Becker et al (US 2002/0006368) in view of Zhou (US 6,500,969) and evidenced by Kinkade (US 4,994,498) as applied to claim 1, and further in view of Miller (US 3,615,256). The addition of Miller does not overcome the deficiencies of Becker et al, Zhou et al, and Kinkade with respect to suggesting independent claim 1 from which claims 4-5 depend. Moreover, with respect to claim 4, Miller does not disclose or teach “a second input for introducing a backpressure pulse of gaseous material into the hollow interior region through the port”, as recited in part in claim 4. Miller teaches that “the filter

assemblies are cleared by subjecting them to blowback, preferably one at a time. This is achieved by closing a valve 48 and opening the associated valve 52 so that blowback gas flows through the selected filter assembly into the separation zone 22." *Miller col. 3, lines 66-70 (emphasis added)*. The separation zone 22 or "catalyst separation chamber 22" (*Miller col. 2, lines 53-54*) of Miller is not the "hollow interior region" of claim 4. As recited in claim 1 from which claim 4 depends, the reactor system includes, for example, "a first input for introducing a contaminated gas into the hollow interior region." The separation zone 22 of Miller does not have a first input for introducing a contaminated gas. The separation zone 22 of Miller is a distinct region that is divided from the fluid bed by "a continuous wall 20 in the form of an inverted cone." *Miller col. 2, line 52-53*. Miller discloses that "wall 20 serves to subdivide the interior of the vessel to provide a catalyst separation chamber 22. Wall 20 is located some distance above the level 18 of the fluid bed, thereby providing a disengaging zone 24 for the catalyst." *Miller col. 2, lines 53-56 (emphasis added)*. Miller even states that "the temperatures and pressures within the fluid bed reaction zone may be different (e.g., higher) than within the separation chamber" (*col. 5, lines 11-14*) and that "in fact the apparatus may comprise two vertically spaced vessels connected by the catalyst return pipe 26 and the pipes 56, with the upper vessel comprising the separation zone and the lower vessel comprising the fluid bed reaction zone and the catalyst-disengaging zone" (*col. 5, lines 14-16-21*).

Moreover, with respect to claim 5, Miller does not disclose or teach "the entrance of the backpressure pulse into the hollow interior region through the port displaces collected catalyst nanoparticles and allows said collected catalyst nanoparticles to flow through the port directly back into the hollow interior region to join the fluidized

catalyst nanoparticles and continue catalyzing the break down of contaminated gas within the hollow interior region”, as recited in part in claim 5 (emphasis added). As explained above with respect to claim 4, Miller does not disclose or suggest “the entrance of the backpressure pulse into the hollow interior region through the port.” And the blowback gas of Miller does not allow the catalyst particles to flow through the port 36 of Miller. Furthermore, the catalyst particles of Miller displaced by the blowback gas do not “flow through the port directly back into the hollow interior region to join the fluidized catalyst nanoparticles and continue catalyzing the break down of contaminated gas within the hollow interior region.” Rather, the catalyst particles of Miller are blown into the separation chamber 22 and then enter the catalyst return pipe 26 before they are returned to the fluidized bed. The “catalyst trickles back to the catalyst bed from the separation chamber 22.” *Miller col. 2, lines 62-63*. Again, Miller states, “The separated catalyst dust drops down onto the wall 20 from which it is returned to the fluidized bed by return pipe 26 at a rate determined by the setting of trickle valve 28.” *Miller col. 3, lines 54-57*. Withdrawal of the rejection of claims 4-5 under 35 U.S.C. 103(a) is respectfully requested.

Claim 6 was rejected under 35 U.S.C. 103(a) as being unpatentable over Becker et al (US 2002/0006368) in view of Zhou (US 6,500,969) and evidenced by Kinkade (US 4,994,498) as applied to claim 1, and further in view of Goswami (US 5,933,702). The addition of Miller does not overcome the deficiencies of Becker et al, Zhou et al, and Kinkade with respect to suggesting independent claim 1 from which claim 6 depends. Moreover, with respect to claim 6, there is no reason to combine Goswami with the other references. Goswami is directed to destroying microorganisms in air by photocatalytic

oxidation. Goswami discloses a “master reactor 21 along the duct 18” of an air conditioning system. *Goswami col. 6, line 13*. The reactor 21 includes a catalyst-coated liner 29 and/or a catalyst-coated mesh or matrix of surfaces 28, where “the catalyst-coated liner and mesh are referred to collectively as catalytic inserts.” *Goswami col. 6, lines 18-24*. And the “mesh 28 may be made out of any material to which a photocatalyst will adhere by conventional methods. The duct liners 29 may be made of any material that will allow the deposition and adherence of a photocatalyst on its interior surface 31 by conventional methods.” *Goswami col. 6, lines 58-62*. The humidifier 50 of Goswami is used to humidify the circulating air to “a relative humidity grater than about 40%” (*col. 7, lines 66-67*) because “the relative humidity level of the air is critical for the destruction of microorganisms” (*col. 7, lines 61-62*). Thus, Goswami does not disclose or suggest in any way a fluidized bed reactor system. There is no reason to use the humidifier 50 of Goswami in the fluid bed reactor of Becker et al, and the combined teachings of Goswami, Becker et al, Zhou et al, and Kinkade do not result in the limitations of claim 6. Becker et al is not concerned with destroying microorganisms. Goswami specifically describes the adherence of the photocatalyst to the mesh 28 or duct liners 29—nothing in Goswami suggests “the fluidizing material fluidizes at least a portion of the plurality of catalyst nanoparticles located at the lower surface of the chamber to form a gaseous dispersion.” Goswami also does not disclose or suggest “a plurality of catalyst nanoparticles within the hollow interior region and located on the lower surface, wherein the catalyst nanoparticles have an average particle diameter of about 15 nm to about 25 nm, and wherein the catalyst nanoparticles are capable of catalyzing the break down of a contaminated gas to produce a decontaminated gas comprising carbon dioxide.” Nor does Goswami disclose or suggest

“a fluidizing input, located downstream of the first input, for introducing a fluidizing material into the hollow interior region.” Withdrawal of the rejection of claim 6 under 35 U.S.C. 103(a) is respectfully requested.

Claim 7 was rejected under 35 U.S.C. 103(a) as being unpatentable over Becker et al (US 2002/0006368), Zhou (US 6,500,969), and Miller (US 3,615,256), and evidenced by Kinkade (US 4,994,498) as applied to claim 4, and further in view of Ballantine et al (US 2006/0078771). The addition of Ballantine et al does not overcome the deficiencies of Becker et al, Zhou et al, Miller, and Kinkade with respect to suggesting independent claim 1 from which claim 7 depends. Moreover, with respect to claim 7, there is no reason to combine Ballantine et al with the other listed references and Ballantine et al does not disclose or suggest the limitations of claim 7. Ballantine et al is directed to a fuel cell system and has nothing to do with a fluidized-bed reactor system. The fuel cell system of Ballantine et al has “the ability to periodically alternate the direction of reactant flows through the fuel cell stack.” *Ballantine et al page 4, paragraph [0039]*. Ballantine et al teaches that in “operating state B”, valve 401 is closed and valve 402 is open. Then “[w]hen the system is switched to operating state A, . . . valve 402 is closed and valve 401 is opened.” *Ballantine et al page 4, paragraph [0042]*. Ballantine et al does not disclose or suggest any of the limitations of claim 7. For example, Ballantine et al says nothing about a “second input for introducing a backpressure pulse of gaseous material into the hollow interior region” or a “first input for introducing a contaminated gas into the hollow interior region” or a “fluidizing input for introducing a fluidizing material into the hollow

interior region.” Withdrawal of the rejection of claim 7 under 35 U.S.C. 103(a) is respectfully requested.

Claims 18-20 were rejected under 35 U.S.C. 103(a) as being unpatentable over Becker et al (US 2002/0006368) and Zhou (US 6,500,969) and evidenced by Kinkade (US 4,994,498) as applied to claim 1, and further in view of Sigai (US 4,585,673). The addition of Sigai does not overcome the deficiencies of Becker et al, Zhou et al, and Kinkade with respect to suggesting independent claim 1 from which claims 18-20 depend. Moreover, with respect to claim 18, Sigai does not disclose or teach “a means for agitating the catalyst nanoparticles within the hollow interior region.” Sigai discloses a method for applying a protective coating to the surface of individual phosphor particles. Sigai describes the difficulty in fluidizing the phosphor particles:

Difficulty is encountered, however, in attempting to fluidize fine phosphor powders, i.e., phosphor powders with particles having an average particle size of less than about 20 microns. The difficulty in fluidizing the particles of fine phosphor powder arises from interparticle adhesive forces which cause agglomeration and bridging between the agglomerates. Such agglomeration and bridging of agglomerates normally results in the formation of channels through the bed thereby causing the gas to pass through the channels without fluidizing the particles. Under these circumstances, there is little or no powder bed expansion.

Sigai col. 4, lines 18-26. To overcome the difficulty in fluidizing the particles, Sigai discloses a “fluidizing aid” to be mixed with the phosphor powder, and additional agitation. “In a preferred embodiment of the present invention, both the fluidizing aid and the additional agitation are used together in order to fluidize the phosphor powder and improve the expansion of the fluidized bed.” *Sigai col. 4, lines 46-50.* Sigai says nothing about catalyst particles or catalyst nanoparticles. And Sigai does not teach or suggest

particles “within the hollow interior region” of a fluidized-bed reactor system, where, for example, the system includes “a first input for introducing a contaminated gas into the hollow interior region, the contaminated gas comprising at least one hydrocarbon contaminant.” Claims 19 and 20 depend from 18 and are patentable on the same basis. Withdrawal of the rejection of claims 18-20 under 35 U.S.C. 103(a) is respectfully requested.

Claims 25, 27-30, and 32-34 were rejected under 35 U.S.C. 103(a) as being unpatentable over Becker et al (US 2002/0006368) in view of Zhou (US 6,500,969), Ballantine et al (US 2006/0078771), and Miller (US 3,615,256), and further evidenced by Kinkade (US 4,994,498). Independent claim 25 recites in part a fluidized bed reactor system including “a plurality of catalyst nanoparticles capable of catalyzing the break down of a contaminated gas to produce a decontaminated gas comprising carbon dioxide” and “a reaction product comprising carbon dioxide in the hollow interior region.” Becker et al does not teach or suggest these limitations. Becker et al discloses a fluid bed reactor for use in synthesis reactions, not decomposition reactions. Specifically, Becker et al states that “suitable processes . . . for use in the present invention include (a) the acetoxylation of olefins, for example the reaction of ethylene, acetic acid and oxygen to produce vinyl acetate, (b) the oxidation of ethylene to acetic acid and/or the oxidation of ethane to ethylene and/or acetic acid, (c) the ammoxidation of propylene, propane or mixtures thereof to acrylonitrile and (d) the oxidation of C4's to maleic anhydride.” *Becker et al. page 3, paragraph [0028], [0035], and [0037]*. Becker et al also does not teach or suggest a fluidized bed reactor system including “the first input configured to direct a contaminated

gas into the hollow interior region, the contaminated gas comprising at least one hydrocarbon contaminant”, as recited in part in claim 25. The Office Action points to “inlet (6)” of Becker et al, but Becker et al states that the reactor “is provided with . . . a supply of fluidising gas comprising recycle gases, ethylene reactant and optionally oxygen reactant through inlet (6).” *Becker et al, page 3, paragraph [0032]*.

Also with respect to claim 25, the Office Action recognizes that Becker does not teach nanoparticles, then Office Action states that it would have been obvious to use the nanoparticles of Zhou in the reactor of Becker “in order to ensure high activity and selectivity of the desired oxidation products.” *Office Action, pages 17-18*. But Zhou does not disclose or suggest the “plurality of catalyst nanoparticles capable of catalyzing the break down of a contaminated gas to produce a decontaminated gas comprising carbon dioxide.” Zhou et al discloses that in the first of a two-stage process, “nanometer-size crystals of supported particles of noble metal catalyst” are used to catalyze the formation of “hydrogen peroxide intermediate . . . at hydrogen concentrations below the flammability limits of hydrogen.” *Zhou, col. 5, lines 3-8*.

Also with respect to claim 25, Miller does not disclose or teach “the second input configured to direct a backpressure pulse of gaseous material into the hollow interior region through the gas permeable separation device”, as recited in part in claim 25. Miller teaches that “the filter assemblies are cleared by subjecting them to blowback, preferably one at a time. This is achieved by closing a valve 48 and opening the associated valve 52 so that blowback gas flows through the selected filter assembly into the separation zone 22.” *Miller col. 3, lines 66-70 (emphasis added)*. The separation zone 22 or “catalyst separation chamber 22” (*Miller col. 2, lines 53-54*) of Miller is not the “hollow interior

region” of claim 4. As recited in claim 25, the reactor system includes, for example, “the first input configured to direct a contaminated gas into the hollow interior region.” The separation zone 22 of Miller does not have a first input for introducing a contaminated gas. The separation zone 22 of Miller is a distinct region that is separated by from the fluid bed by “a continuous wall 20 in the form of an inverted cone.” *Miller col. 2, line 52-53*. Miller discloses that “wall 20 serves to subdivide the interior of the vessel to provide a catalyst separation chamber 22. Wall 20 is located some distance above the level 18 of the fluid bed, thereby providing a disengaging zone 24 for the catalyst.” *Miller col. 2, lines 53-56 (emphasis added)*.

Moreover, with respect to claim 25, Miller does not disclose or teach “the second input configured to direct a backpressure pulse of gaseous material into the hollow interior region through the gas permeable separation device for displacing the plurality of catalyst nanoparticles previously collected on the gas permeable separation device therefrom, and allowing the plurality of catalyst nanoparticles displaced from the gas separation device to directly join the fluidized dispersion of catalyst nanoparticles and continue catalyzing the break down of the contaminated gas within the hollow interior region”, as recited in part in claim 25 (emphasis added). The blowback gas of Miller does not allow the catalyst particles to “directly join the fluidized dispersion” and “continue catalyzing the break down of the contaminated gas.” Rather, the catalyst particles of Miller are blown into the separation chamber 22 and then enter the catalyst return pipe 26 before they are returned to the fluidized bed. The “catalyst trickles back to the catalyst bed from the separation chamber 22.” *Miller col. 2, lines 62-63*. Again, Miller states, “The separated catalyst dust drops down onto the wall 20 from which it is returned to the

fluidized bed by return pipe 26 at a rate determined by the setting of trickle valve 28.”

Miller col. 3, lines 54-57.

Also with respect to claim 25, Ballantine et al does not disclose or suggest “at least one control device coupled to the second input and at least one of the first and fluidizing inputs, the at least one control device configured to alternate the backpressure pulse of gaseous material through the gas permeable separation device with an entrance of at least one of the contaminated gas and the fluidizing material into the hollow interior region.” Ballantine et al is directed to a fuel cell system and has nothing to do with a fluidized-bed reactor system. The fuel cell system of Ballantine et al has “the ability to periodically alternate the direction of reactant flows through the fuel cell stack.” *Ballantine et al page 4, paragraph [0039]*. Ballantine et al teaches that in “operating state B”, valve 401 is closed and valve 402 is open. Then “[w]hen the system is switched to operating state A, . . . valve 402 is closed and valve 401 is opened.” *Ballantine et al page 4, paragraph [0042]*. Ballantine et al does not disclose or suggest any of the limitations of claim 25. For example, Ballantine et al says nothing about a “the first input configured to direct a contaminated gas into the hollow interior region, the contaminated gas comprising at least one hydrocarbon contaminant” or a “second input configured to direct a backpressure pulse of gaseous material into the hollow interior region through the gas permeable separation device for displacing the plurality of catalyst nanoparticles previously collected on the gas permeable separation device therefrom” or a “fluidizing input configured to direct a fluidizing material toward the lower surface and between about 0° to 90° with respect to the lower surface and the plurality of catalyst nanoparticles for fluidizing at least a portion of the plurality of catalyst nanoparticles and creating a gaseous

dispersion of catalyst nanoparticles that catalyzes the break down of the contaminated gas to produce a decontaminated gas and carbon dioxide.”

Claims 27-30 and 32-34 depend from claim 25 and are patentable on the same basis. Moreover, none of the cited references disclose or suggest “the at least one control device comprises at least one of a needle valve, a solenoid, a computer, a generator and a sensor”, as recited in part in claim 27. None of the cited references disclose or suggest “wherein the at least one control device is configured to introduce the backpressure pulse of gaseous material at a force based on at least one of a volume of the hollow interior region, a density of the contaminated gas, a concentration of the contaminated gas, a composition of the contaminated gas, a composition of the plurality of catalyst nanoparticles, an internal pressure of a contaminated gas source, a temperature of a contaminated gas source and a particle build up in the chamber of the fluidized-bed reactor”, as recited in part in claim 28.

Regarding claim 30, neither Becker nor Miller teaches or suggests “wherein the second input has a decontaminated gas passage way, the decontaminated gas passage way configured to receive the decontaminated gas exiting from the hollow interior region through the port and the gas permeable separation device, the decontaminated gas passage way further configured to recycle the decontaminated gas through at least one of the fluidizing inlet and the port into the hollow interior region.” The second input (blowback gas pipe) 50 of Miller does not have such “a decontaminated gas passage way.” Nowhere does Miller state or suggest that the blowback gas pipe 50 is configured to do anything but contain blowback gas. Miller states, “Pipe 50 is connected to a source of high-pressure blowback gas.” *Miller col. 3, lines 14-15*. In describing the “straightforward” operation of

the reactor, *col. 3, line 38*, Miller also states that “the filter assemblies are cleared by subjecting them to blowback, preferably one at a time. This is achieved by closing a valve 48 and opening the associated valve 52 so that blowback gas flows through the selected filter assembly into the separation zone 22. Blowback gas is allowed to flow for a period (usually in the order of 5 minutes) sufficient to remove the catalyst buildup. Thereafter the open valve 52 is reclosed and closed valve 48 is reopened to restore the filter assembly to an operative state.” *Miller col. 3, lines 66-74*.

Regarding claim 32, neither Becker nor Miller teaches or suggests “wherein the at least one control device includes a filtration device and a gauge, the filtration device in communication with a decontaminated gas passage way, the filtration device configured to collect the plurality of catalyst nanoparticles that bypasses the gas permeable separation device from the hollow interior region, and the gauge configured to generate a signal indicative of a quantity of catalyst nanoparticles that bypasses the gas permeable separation device, the signal being received by another control device.” Regarding claim 33, neither Becker nor Miller teaches or suggests “wherein the gauge is further configured to determine a pressure within the fluidized bed reactor system.” The Office Action points to Miller, col. 5 lines 11-26, but this portion of Miller does not disclose any of the limitations in claims 32 and 33. The only reference to pressure in Miller, column 5, lines 11-26 is the statement that “the temperatures and pressures within the fluid bed reaction zone may be different (e.g., higher) than within the separation chamber.” Applicants fail to see any teaching in either Becker or Miller of a “filtration device . . . that is configured to detect a drop a pressure across the filer in order to assess the amount of catalyst particles that have collected on the boundary layer” as stated on page 22 of the Office Action.

Withdrawal of the rejection of claims 25, 27-30, and 32-34 under 35 U.S.C. 103(a) is respectfully requested.

Claim 26 was rejected under 35 U.S.C. 103(a) as being unpatentable over Becker et al (US 2002/0006368), Zhou (US 6,500,969), Ballantine et al (US 2006/0078771), and Miller (US 3,615,256) as applied to claim 25, and further evidenced by Breton et al (US 3,997,447). The addition of Breton et al does not overcome the deficiencies of Becker et al, Zhou et al, Ballantine et al, and Miller with respect to suggesting independent claim 25 from which claim 26 depends. Moreover, with respect to claim 26, Breton et al merely discloses that the “frequency of backpulsing and ratio of forward flow to reverse flow” in a fluid processing device can be modified. *Breton et al col. 5, lines 39-43*. Breton et al does not disclose or suggest “wherein the at least one control device is further configured to . . . introduce at least one of the contaminated gas and the fluidizing material into the hollow interior region for about 0.8 seconds.” *Breton et al col. 4, lines 65-67*. Withdrawal of the rejection of claim 26 under 35 U.S.C. 103(a) is respectfully requested.

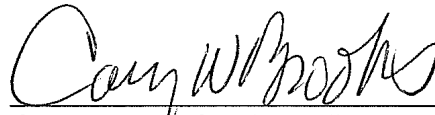
Claim 31 was rejected under 35 U.S.C. 103(a) as being unpatentable over Becker et al (US 2002/0006368), Zhou (US 6,500,969), Li et al (US 6,782,892), Ballantine et al (US 2006/0078771), and Miller (US 3,615,256) as applied to claim 30, and further in view of Choudhary et al (US 5,936,135). Applicants note that the Li et al reference was not applied to claim 30 in the Office Action. Claim 30 was rejected over Becker et al in view of Zhou, Ballantine et al and Miller and further evidenced by Kinkade, and is patentable for the reasons given above. In any event, the Office Action has not established

a prima facie case of obviousness with respect to claim 31. Claim 31 depends from claim 25 and is patentable on the same basis. The addition of Li et al and Choudhary et al do not overcome the deficiencies of Becker et al, Zhou et al, Ballantine et al, and Miller with respect to suggesting independent claim 25 from which claim 31 depends. Moreover, Choudhary et al discloses using “an on-line gas chromatograph with a flame ionized detector” to analyze “hydrocarbons in the feed and in the products of the reaction.” *Choudhary et al col. 12, lines 28-30*. Choudhary et al in no way discloses or suggests “a flame ionization detector in communication between the decontaminated gas passage way and the fluidizing input, such that the decontaminated gas passes through the flame ionization detector to the fluidizing input.” Withdrawal of the rejection of claim 31 under 35 U.S.C. 103(a) is respectfully requested.

New claims 35-37 are patentable over all of the cited references. No combination of the cited references teach or disclose the fluidized-bed reactor system of claim 1 or the fluidized bed reactor system of claim 25 “further comprising water vapor as a reactant in the hollow interior region.” No combination of the cited references teach or disclose the method of claim 21 “further comprising introducing water vapor as a reactant into the hollow interior region through the first input.”

In view of the above amendments and remarks, Applicants respectfully request reconsideration and allowance of all the claims now in the case. The Examiner is hereby authorized to charge Assignee’s (General Motors Corporation) Deposit Account No. 07-0960 any fees due with the submission of this Amendment.

Respectfully submitted,

A handwritten signature in black ink, reading "Cary W. Brooks". The signature is written in a cursive, flowing style. The first name "Cary" is written with a large, looped 'C'. The middle initial "W" is smaller and more compact. The last name "Brooks" is written with a large, looped 'B' and a trailing flourish.

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Dated: November 10, 2008